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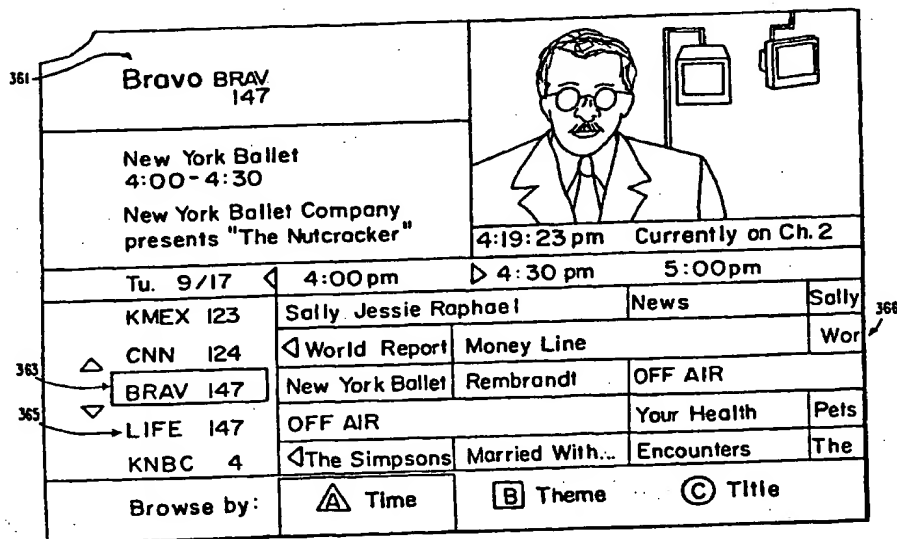
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(54) Title: SYSTEM AND METHOD FOR PROVIDING A FULL SERVICE TELEVISION SYSTEM



(57) Abstract

A system and method are provided for providing a full service cable television system. The cable system incorporates a digital and analog transmission architecture capable of delivering a high number of high quality television programs, advanced cable services, and online services to a subscriber's home. The cable system comprises a cable headend, at least one fiber transport, at least one distribution hub, at least one hybrid fiber coax plant, and a plurality of set-top terminals. Programs and services are transmitted to the set-top terminals in both digital and analog formats to maintain downward compatibility with existing systems. The set-top terminal incorporates a central processing unit, a unified memory architecture, a memory management unit, communications circuitry, I/O control circuitry, and audio and video output circuitry. Through these components the set-top terminal provides advanced cable services.

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SYSTEM AND METHOD FOR PROVIDING
A FULL SERVICE TELEVISION SYSTEM

Background of the Invention ,

5 This invention relates generally to
television systems. More particularly, this invention
relates to full service television systems which
utilizes advanced storage, communications, and
processing techniques to provide a variety of
10 television services including television programming,
music programming, advanced navigation controls,
interactive program guides, Impulse Pay-Per-View
activation, Near-Video-On-Demand programming, Video-On-
Demand programming, advanced configuration controls,
15 and online services.

 With the advances realized in recent years in
storage, communication, and processing technologies,
many present-day television systems are on the verge of
becoming antiquated. This is especially true in many
20 cable television systems. Traditional methods of
broadcasting television programs and services in these
cable television systems suffer in their ability to
deliver a high number of high quality television
signals on a single coaxial cable. Many existing
25 television systems also have no capability to provide
the advanced television services desired by their
customers, such as a comprehensive channel navigator,

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an interactive program guide, Impulse Pay-Per-View activation, Near-Video-On-Demand programming, Video-On-Demand programming, and advanced configuration controls. Furthermore, virtually all modern television systems have no provisions whatsoever to supply services such as World Wide Web browsing, Internet E-Mail, and online services.

In view of the foregoing, it would be desirable to provide a full service television system capable of delivering a high number of high quality television signals.

It also would be desirable to provide a full service television system capable of using advanced communications techniques to deliver a high number of high quality television signals.

It would be further desirable to provide a full service television system capable of sustaining two-way communications between a service provider and a service subscriber.

It would be even further desirable to provide a full service television system capable of delivering advanced television services such as a comprehensive channel navigator, an interactive program guide, Impulse Pay-Per-View activation, Near-Video-On-Demand programming, Video-On-Demand programming, and advanced configuration controls.

It would be still further desirable to provide a full service television system capable of delivering services such as World Wide Web browsing, Internet E-Mail, and online services.

Summary of the Invention

It is therefore an object of this invention to provide a full service television system capable of

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channel Multi-point Distribution Systems (MMDS), Asymmetric Digital Subscriber Loop (ADSL) systems, Local Area Network (LAN) systems, and Wide Area Network (WAN) systems, for example.

5 Preferred cable television system implementations of the present invention comprise a cable headend, at least one fiber transport, at least one distribution hub, at least one hybrid fiber coax plant, and a plurality of set-top terminals. In these
10 implementations, the cable headend provides programs, services, and overall system control for the cable television system; the fiber transports, distribution hubs, and hybrid fiber coax plants provide an advanced communication network for the cable television system;
15 and the set-top terminals provide interfaces, processing, and storage assets in the subscriber's home to facilitate the implementation of advanced television and online services.

In order to provide programs, services, and
20 overall system control for the cable television system of the preferred embodiments of the present invention, the cable headend incorporates digital and analog satellite receivers, a broadcast cable gateway, integrated receiver decoders, analog scrambling and
25 modulation, application and media servers, an addressable controller, a digital switch or multiplexer, and an interactive cable gateway. Although these elements will be described herein as distinct functions, each could be implemented as a
30 single device, as a composition of devices, or as a portion of a device.

Programs and services which are provided by the cable headend are primarily supplied to the cable headend through analog and digital satellite broadcasts

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delivering a high number of high quality television signals.

It is another object of this invention to provide a full service television system capable of using advanced communications techniques to deliver a high number of high quality television signals.

It is still another object of this invention to provide a full service television system capable of sustaining two-way communications between a service provider and a service subscriber.

It is yet another object of this invention to provide a full service television system capable of delivering advanced television services such as a comprehensive channel navigator, an interactive program guide, Impulse Pay-Per-View activation, Near-Video-On-Demand programming, Video-On-Demand programming, and advanced configuration controls.

It is a further object of this invention to provide a full service television system capable of delivering services such as World Wide Web browsing, Internet E-Mail, and online services.

These and other objects of the present invention are achieved by providing a full service television system which incorporates digital and analog programs and services, an advanced communications network, and a fully programmable set-top terminal capable of advanced television and online services.

In the preferred embodiments of the present invention, the full service television system is implemented as a cable television system. Although a cable television system is described herein, the present invention, and all of its features, could be implemented in other forms of cable television systems, or in Direct Broadcast Satellite (DBS) systems, Multi-

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bandwidth requirements of the media servers and the limited bandwidth capabilities of present day networks. Programs and services transmitted through the digital switch or multiplexer from the application and media servers are converted by the interactive cable gateway to a format suitable for transmission in the cable system's communication network. By connecting the application and media servers to the interactive cable gateway through the digital switch or multiplexer, a cable system operator is enabled to add new application and media servers to the cable television system as the new servers become required.

Overall system control is provided by the cable headend primarily through the operation of an addressable controller. The functions performed by the addressable controller may include, for example, controlling the cooperation and inter-operation of all equipment in the cable headend, managing the cable television system's communication network, controlling all equipment located in the system's communication network, managing and configuring the set-top terminals (preferably both set-top terminals of the present invention as well as set-top terminals deployed at the time of implementation of the present invention), controlling the operation of the distribution hubs, controlling the operation of the interactive cable gateway, and controlling the distribution of programs and services from the integrated receiver decoders, broadcast cable gateway, application servers, and media servers to the set-top terminals.

The communication network of the cable television systems of the preferred embodiments of the present invention comprise at least one fiber transport, at least one distribution hub, and at least

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and through digital data storage. The cable headend may also receive programs and services from sources such as analog off-air signals, digital off-air signals, and locally originated signals, for example.

5 Analog and digital satellite broadcasts are received at the cable headend by a plurality of analog and digital satellite receivers. Integrated receiver decoders within the cable headend control the reception of the analog satellite broadcasts and analog
10 scrambling and modulation converts the analog signals into a format suitable for transmission over the cable system's communication network. Similarly, a broadcast cable gateway within the cable headend controls the reception of the digital satellite broadcasts and
15 converts the digital signals into a format suitable for transmission over the cable system's communications network.

 Programs and services are also supplied to the cable headend through digitally stored data in
20 application and media servers. Programs and services stored in the application and media servers are transmitted to the cable system's communication network by first transmitting the signals through a digital switch or multiplexer and then through an interactive
25 cable gateway. The digital switch or multiplexer may be implemented through the use of an Asynchronous Transfer Mode switch, a Digital Video Broadcast Asynchronous Serial Interface (DVB ASI), or other suitable means. The application servers may be
30 connected directly to the digital switch or multiplexer, or may be connected to the digital switch or multiplexer via an intermediate network. The media servers, however, should be connected to the digital switch or multiplexer directly because of the high

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selected fiber optic cables within the fiber transport's bundle, the distribution hubs may be connected to the cable headend in a logical "ring," wherein each hub is connected to the headend through adjacent hubs, in a logical "star," wherein each hub is
5 connected directly to the headend, or in any other logical configuration.

The distribution hubs comprise a plurality of data channel gateways, each of which are used to
10 transceive data messages sent between the cable headend and the set-top terminals. The data channel gateways provide routing functions, modulation functions on the signals going to the set-top terminals, and demodulation functions on the signals coming from the
15 set-top terminals. The routing, modulation, and demodulation functions performed by the data channels gateways are all controllable by the addressable controller within the cable headend.

The hybrid fiber coax plants connect the
20 distribution hubs to the set-top terminals and each comprise fiber optic cable, a node, and a plurality of coaxial cables. The node in each hybrid fiber coax plant is used to convert optical signals to electrical signals and electrical signal to optical signals so
25 that two-way communication can be maintained over the fiber optic and coaxial cables connecting the distribution hubs and set-top terminals.

The digital and analog programs and services furnished by the cable headend are presented to the
30 cable subscribers by set-top terminals within their homes. In the preferred embodiments of the present invention, the set-top terminals each comprise a central processing unit, memory, a memory management unit, communications circuitry, I/O control circuitry,

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one hybrid fiber coax plant. The communications network preferably shall include analog channels with Vertical Blanking Interval (VBI) signals, Forward Application Transport (FAT) channels, Forward Data Channels (FDC), and Reverse Data Channels (RDC). Analog channels with VBI signals are used to maintain downward compatibility with existing cable television equipment. FAT channels are used to provide to the set-top terminals compressed digital content, such as video, audio, applications, control messages, and broadcast data, for example. Forward Data Channels are used to carry to the set-top terminals out-of-band Internet Protocol (IP) datagrams containing messages regarding matters such as conditional access, entitlement, broadcast data, network management, general messaging, application download, external device data services, and Variable Bit-Rate (VBR) download, for example. Furthermore, all Interactive Program Guide data is carried to the set-top terminals exclusively over the out-of-band Forward Data Channels. Reverse Data Channels are used to carry from the set-top terminals to equipment within the cable headend, IP datagram messages regarding matters such as network management, general messaging, external device data services, and program and service control and activation, for example.

The fiber transports carry signals between the cable headend and the distribution hubs and are preferably each physically configured in a ring connecting typically five distribution hubs to the cable headend. Each of the fiber transports comprises a bundle of at least one fiber optic cable, at least one of which is used by each distribution hub on the physical ring of each fiber transport. By using

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advanced configuration controls. Additionally, because the set-top terminal is designed to be upgradable after deployment by software downloads from the cable headend, new services may be added to the set-top terminals as the new services become available.

The comprehensive channel navigation controls provided by the application software of the set-top terminal enable the cable subscriber to more easily navigate through the abundance of programming and services which are available in the preferred embodiments of the present invention. For example, a program information banner may be displayed whenever the user changes channels to help the user identify programs being presented on each channel. This banner may include: the channel's call sign, number, and logo; the program's name, running time, and elapsed time; the current time; a brief description of the current program; information regarding the program following the current program; or any other information of interest to the viewer.

The navigation controls of the preferred embodiments of the present invention utilize a plurality of tables to cross-reference channel numbers to the type, source, and description of programs and services provided by the cable system. These tables create a level of indirection between the displayed channel number and the programs and services being provided, and thereby allow a single mechanism, such as a channel number, to control a variety of different types and sources of programs and services. Unlike traditional cable systems in which channel numbers are fixed to the analog broadcast frequency of the corresponding television station, this arrangement also allows programs and services to be arranged in any

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and audio and video output circuitry. Each set-top terminal is controlled by the central processing unit executing operating system and application software stored within the memory. The memory management unit is used to simplify and oversee the interaction between the central processing unit and the memory. Communications circuitry in the set-top terminal receives, demodulates, decrypts, decodes, and descrambles programs and services transmitted by the cable headend. Additionally, the communication circuitry also provides control over the two-way digital data transmissions between the headend and the set-top terminal. I/O control circuitry is provided to control the user interaction with the set-top terminal through a keypad, LED display, and remote control. Also, the I/O control circuitry interfaces the set-top terminal to external equipment through an I/R transmitter, an accessories bus, and interfaces such as Ethernet 10-base-T, P1394, and SPDIF, for example. Audio and video control circuitry in each set-top terminal provides graphics generation, audio synthesis, and real-time digital video processing, and generates the outputs necessary to interface the set-top terminal to the subscriber's home audio and video system. These audio and video outputs may include, for example, AC-3 audio, baseband audio, RF video, S-Video, and baseband video outputs.

In the preferred embodiments of the present invention, application software within the set-top terminal provides the advanced cable services desired by many cable subscribers. These services include a comprehensive channel navigator, an interactive program guide, Impulse Pay-Per-View activation, Near-Video-On-Demand programming, Video-On-Demand programming, and

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elapsed time; the current time; a brief description of the current program; information regarding a program following the browse program; or any other information of interest to the viewer.

5 The preferred embodiments of the present invention also provide channel settings controls which enable the cable subscriber to fully configure the set-top terminal to operate as desired. For example, the subscriber may: assign channels to a favorite channel
10 list; block channels based upon channel number, time, program rating, genre, etc.; setup timers to record a particular program; turn the set-top terminal on or off at a particular time; and remind the subscriber that a particular program is on or that a tape has to be put
15 in an attached VCR to record a program airing in the near future.

 An interactive program guide within the set-top terminal of the preferred embodiments of the present invention further allows the user to easily
20 operate the set-top terminal and navigate through the abundance of programs and services available in the cable television system. This interactive program guide may have any of at least three main modes: a time mode, a theme mode, and a title mode. In the time
25 mode, program information is displayed in an arrangement utilizing a grid with rows corresponding to channel numbers and columns corresponding to times. By navigating through this grid the user may identify and review information regarding programs which were, are,
30 or will be available for viewing. The theme mode of the present invention displays program information on programs which were, are, or will be available for viewing based upon a user selected theme category. Once a theme category has been selected, all programs

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channel number order regardless of how they are transmitted to the set-top terminals. For example, a channel table might identify a channel number 1 as being associated with a video service that comes from a source number 10. Alternatively, channel number 1 could be associated with a music service that comes from a source number 1. By identifying the type of service associated with each channel, the set-top terminal remains aware of whether software needs to be executed in order to implement a particular service when the corresponding channel number is selected by a subscriber. For example, if a channel number 10 corresponding to a World Wide Web browsing or Internet E-Mail service is selected by a subscriber, a service type identifier in a service table indexed by channel number might instruct the set-top terminal to execute the appropriate World Wide Web browser or Internet E-Mail software. Furthermore, using tables to cross reference channel numbers to sources of programs and services allows channel settings (such as favorite and blocked channels) to be identified with the sources rather than the channel numbers of particular programs and services. In this way, channel settings stay with the corresponding programs and services even when their channel numbers are rearranged by the cable provider.

A browse feature is also provided by the comprehensive navigation controls in the preferred embodiments of the present invention. The browse feature presents a banner to the user through which the user can identify other programs or services that are, were, or will be available for viewing on other channels. Similarly to the program information banner, the browse banner may include: a channel's call sign, number, and logo; a program's name, running time, and

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or a program selected at the headend, and the content of the program in the program viewing window may incorporate any of the programs or services which can be displayed by the set-top terminal. The program
5 viewing window may also incorporate a time and channel banner indicating the current time and the channel being displayed in the program viewing window. The mode indicators may indicate to the user of the interactive program guide the current mode of the
10 interactive program guide and how to activate other available modes of the interactive program guide.

The interactive program guide of the preferred embodiments of the present invention also facilitates rapid navigation to programs selected by
15 the user. Once the user has found a desired program in the interactive program guide, the user may, by pressing a single key, choose to switch to the program in cases where the program is currently being transmitted, set a reminder timer to remind the user
20 about the program in cases where the program is a future transmission, or select to record the program in all cases.

Impulse Pay-Per-View (IPPV) program purchasing is also facilitated in the preferred
25 embodiments of the present invention. Through Impulse Pay-Per-View, a user is able to request a Pay-Per-View event from the set-top terminal's keypad or remote control. Upon the user selecting an IPPV program, either through the interactive program guide, manual
30 channel selection, or setting a record timer, the set-top terminal automatically identifies channels and programs which are IPPV, queries whether the user would like to purchase the selected IPPV channel or program, and authorizes the purchase if the user wishes to do

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within that theme are displayed to the user. In some embodiments of the present invention, in addition to being able to scroll through the programs corresponding to the selected theme, the user may also scroll to other themes after an end of the list of programs corresponding to the selected theme has been reached. Similar to the theme mode, the title mode lists and displays information on programs available for viewing based upon the titles of the programs. Once a first letter of the to-be-displayed programs has been selected, all programs having titles beginning with that letter which programs were, are, or will be available for viewing are displayed to the user. As with themes, in some embodiments of the present invention, the user is not limited to viewing only those programs with titles beginning with the selected letter, but rather the user may scroll to programs titles beginning with other letters once an end of the program titles beginning with the selected letter has been reached.

All modes of the interactive program guide of the preferred embodiments of the present invention may also include a highlighted channel banner, a highlighted program summary, a program viewing window, and mode indicators. The highlighted channel banner may indicate the call sign, channel number, and channel logo of the channel highlighted in the interactive program guide display. The highlighted program summary may indicate the title, running time, description, and characteristics of the program highlighted in the interactive program guide display. The program viewing window may, for example, display the program being viewed prior to entering the interactive program guide, a program selected from the interactive program guide,

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Similarly, skipping forward and skipping backward are achieved by switching to another source for the NVOD program without waiting for the period of the time delay. For example, skipping forward switches to a
5 transmission which began prior to the currently viewed transmission, and skipping backward switches to a transmission which began after the currently viewed transmission. By switching to a different source of the NVOD transmission, the NVOD program appears to have
10 jumped by the period of the time delay between transmissions.

Video-On-Demand is facilitated in the preferred embodiments of the present invention primarily by the media servers' ability to deliver
15 high-speed digital data to the subscribers' set-top terminals. Upon a request to view a VOD event from a user, a media server capable of delivering the VOD event begins digitally transmitting the program to the cable subscriber's set-top terminal. Unlike
20 traditional broadcasts, typically this transmission is received only by the user who requested the VOD event. Because of this, a subscriber may select to begin viewing the program at any time, and may also select to suspend (pause), reverse (rewind), or accelerate (fast
25 forward) the program being transmitted.

Finally, the preferred embodiments of the present invention also allow for the transmission of messages to one or more users. These messages may be sent to all subscribers, in the event of an emergency
30 broadcast for example, or only one, in the event of a past due balance for example. This message system could also be used to send a message from one party within a household to another, for example, an instruction by a parent to a child, or from one

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so. The preferred embodiments of the present invention may also allow the user to view summaries of past and future IPPV purchases and cancel future purchases. Additionally, the IPPV features of the preferred
5 embodiments of present invention may provide for free preview screening of IPPV events, countdown timers to the display of an IPPV event, and automatic reminders that an IPPV event is about to begin if the user has changed channels between the time of ordering and the
10 time of the IPPV event.

Near-Video-On-Demand (NVOD) and Video-On-Demand (VOD) programming may also be implemented in the preferred embodiments of the present invention. NVOD programming operates by transmitting each NVOD program
15 on a plurality of sources, each of which sources is a fixed time period out of phase with the others. Upon a request to view an NVOD program, the set-top terminal displays on an NVOD channel the next beginning source corresponding to that NVOD program. Since a plurality
20 of NVOD sources are associated with each NVOD channel, the set-top terminal simply selects which source to display based upon the time when the user selects to view the program on the NVOD channel. NVOD programming also facilitates pausing, skipping forward, and
25 skipping backward of NVOD programs. This is accomplished by switching sources of the NVOD program. For example, to pause an NVOD program, the set-top terminal displays a pause barker for the period of the time delay between the transmissions of consecutive
30 sources of the NVOD program. Once the period of the time delay has passed, the set-top terminal displays the next source of the program. By selecting the subsequent transmission, the NVOD program appears to have been paused for the period of the time delay.

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FIGS. 6-7 are flow diagrams illustrating a browse function of a set-top terminal of one embodiment of the present invention;

FIG. 8 is layout diagram illustrating a
5 browse banner of one embodiment of the present invention;

FIGS. 9-13 are flow diagrams illustrating channel settings and general settings functions of a set-top terminal of one embodiment of the present
10 invention;

FIG. 14 is an illustrative screen display of a general settings menu of a set-top terminal of one embodiment of the present invention;

FIG. 15 is a flow diagram illustrating a
15 general settings function of a set-top terminal of one embodiment of the present invention;

FIGS. 16-17 are illustrative screen displays of the time mode of an interactive program guide of a set-top terminal of one embodiment of the present
20 invention;

FIG. 18 is a flow diagram illustrating entry, navigation, and tuning within the time mode of an interactive program guide of a set-top terminal of one embodiment of the present invention;

FIG. 19 is a flow diagram illustrating
25 switching modes within an interactive program guide of a set-top terminal of one embodiment of the present invention;

FIGS. 20-21 are illustrative screen displays
30 of the theme mode of an interactive program guide of a set-top terminal of one embodiment of the present invention;

FIGS. 22-23 are illustrative screen displays of the title mode of an interactive program guide of a

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household to another, thereby effecting a local messaging system within the cable system's community. Additionally, these messages may be configured to activate a service within a subscriber's set-top terminal. For example, upon receipt of a message from the headend, a set-top terminal could be caused to automatically turn on, turn on an attached television set, and display an emergency news broadcast. In this way a subscriber would be alerted to an impending crisis even if the subscriber was not watching television at the time of the transmission.

Brief Description of the Drawings

The above and other objects and advantages of the present invention will be apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

FIG. 1 is a system-wide block diagram of a cable television system of one embodiment of the present invention;

FIG. 2 is a system-wide schematic diagram of a cable television system of one embodiment of the present invention;

FIG. 3 is a block diagram of a set-top terminal of one embodiment of the present invention;

FIG. 4 is a flow diagram of a channel navigation function of a set-top terminal of one embodiment of the present invention;

FIG. 5 is a data structure diagram illustrating a channel cross-referencing function of a set-top terminal of one embodiment of the present invention;

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services, and control signals are delivered to the subscribers' set-top terminals 6 from headend 2 by transmitting signals through fiber transport 3, distribution hub 4, and hybrid fiber coax plant 5.

5 These transmissions may be in the form of broadcasts to all set-top terminals, narrowcasts to a group of set-top terminals, multicasts to a list of particular set-top terminals, or unicasts to single set-top terminals. In a preferred embodiment of system 1, the subscribers

10 may also interact with the programs and services provided by headend 2. This is accomplished by set-top terminals 6 in the subscribers' homes transmitting signals back through hybrid fiber coax 5, distribution hub 4, and fiber transport 3 to headend 2. In this

15 way, a two-way, interactive, cable television system is provided. Alternatively, the present invention could also be implemented using a one-way cable television system wherein signals are only transmitted from headend 2 to set-top terminals 6.

20 In order to provide the programs, services, and control of system 1, headend 2 includes a plurality of digital satellite receivers 10, a Broadcast Cable Gateway (BCG) 11, a plurality of analog satellite receivers 12, a plurality of Integrated Receiver

25 Decoders (IRD) 13, analog scrambling and modulation circuitry 20, an Addressable Controller (AC) 14, a plurality of application servers 15, a plurality of media servers 16, a digital switch or multiplexer 17, and an Interactive Cable Gateway (ICG) 18. Although

30 these elements of headend 2 are described as single functions, each could be implemented as a single device, as a plurality of devices, or as part of a single device.

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set-top terminal of one embodiment of the present invention;

FIGS. 24-27 are flow diagrams illustrating the operation of an interactive program guide of a set-top terminal of one embodiment of the present invention;

FIG. 28 is a flow diagram illustrating an Impulse Pay-Per-View function of a set-top terminal of one embodiment of the present invention;

FIG. 29 is an illustrative screen display of an Impulse Pay-Per-View barker of an Impulse Pay-Per-View function of a set-top terminal of one embodiment of the present invention;

FIGS. 30-32 are flow diagrams illustrating the operation of an Impulse Pay-Per-View function of a set-top terminal of one embodiment of the present invention;

FIGS. 33-34 are flow diagrams illustrating the operation of a Near-Video-On-Demand function of a set-top terminal of one embodiment of the present invention; and

FIG. 35 is an illustrative screen display of a messaging function of a set-top terminal of one embodiment of the present invention.

Detailed Description of the Invention

Referring to FIG. 1, a cable television system 1 of one embodiment of the present invention is shown. As illustrated, system 1 comprises five primary components: a headend 2; at least one fiber transport 3; at least one distribution hub 4; at least one hybrid fiber coax plant 5; and a plurality of set-top terminals 6. Headend 2 provides the primary source of programs, services, and control of system 1. Programs,

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herein as being provided by any other of these sources, could be provided by any of these sources without departing from the spirit and scope of the present invention.

- 5 In order to provide this multitude of programs and services to the subscriber's home on a single coaxial cable, these signals are modulated onto a plurality of 6 MHz Frequency Division Multiplexed (FDM) channels in the RF spectrum from 5 MHz through
10 860 MHz. More specifically, the 6 MHz FDM channels in the present invention can be used to carry analog channels with Vertical Blanking Interval (VBI) signals, Forward Application Transport (FAT) channels, Forward Data Channels (FDC), and Reverse Data Channels (RDC).
- 15 In one embodiment of the present invention, the frequencies of the analog channels are in the range of 50 to 500 MHz, the FAT channels are in the range of 500 to 750 MHz, and the FDCs and RDCs are in the ranges of 5 to 40 MHz and 70 to 130 MHz, respectively. Although
20 illustrations of the bandwidth, upper limits, and lower limits for these channels are given herein, these figures could be altered to suit the individual needs and capabilities of any system in which the present invention is implemented without departing from the
25 spirit and scope of the present invention. For example, 1 MHz FDM channels could be implemented wherein each of the analog channels, FAT channels, Forward Data Channels, and Reverse Data Channels utilize different sections of the RF spectrum.
- 30 Analog programs and services are received from satellite transmissions in the preferred embodiments of the present invention by analog satellite receivers 12, integrated receiver decoders 13, and analog scrambling and modulation circuitry 20.

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The programs and services generated by headend 2 are received from four primary sources: analog satellite transmissions from analog service providers, digital satellite transmissions from digital service providers, application programs and services on application servers 15, and media programs and services on media servers 16. Programs and services may also be received at headend 2 from other sources such as analog off-air signals, digital off-air signals, and locally originated signals, for example. Analog and digital satellite transmissions typically provide the traditional forms of television broadcast programs and services, including programs and services such as television programs and information services, for example. Application servers typically provide executable code and data for application specific services such as database services, network management services, transactional electronic commerce services, system administration console services, application specific services (such as stock ticker, sports ticker, weather, and Interactive Program Guide data), resource management services, connection management services, subscriber care services, billing services, operation system services, and object management services, for example. Media servers provide time-critical media assets such as MPEG-2 encoded video and audio, MPEG-2 encoded still images, bit-mapped graphic images, PCM digital audio, three dimensional graphic objects, application programs, and application data files, for example. Although specific examples of programs and services which may be provided by sources such as analog and digital satellite transmissions, application servers, and media servers are given herein, other programs and services, or programs and services listed

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manipulated by BCG 11 to remove unwanted programs from the stream to form an MPEG-2 payload. BCG 11 then encrypts the payload (if desired) and modulates it onto a Forward Application Transport (FAT) 6 MHz FDM
5 channel. The modulation used on the FAT channels is preferably 64 or 256 Quadrature Amplitude Modulation (QAM), which enables the channels to carry digital data at rates typically in the range of 27 or 38 Mbps, respectively. By using MPEG-2 payloads, the present
10 invention provides an increase in the number of programs and services that can be transmitted on a 6 MHz channel over that available with analog technology by digitally compressing and combining a plurality of programs and services into a single MPEG-2 payload.

15 Application and media programs and services are provided by application and media servers 15 and 16 under the control of addressable controller 14 through digital switch or multiplexer 17, interactive cable gateway 18, and data channel gateways 19 in
20 distribution hubs 4. The programs and services provided by application and media servers 15 and 16 are preferably provided in MPEG-2 transport stream format. Addressable controller 14 may oversee the distribution of programs and services by servers 15 and 16 by
25 processing requests for programs and services from the set-top terminals, instructing the servers when, how, and where to deliver a requested program or service, and directing the programs and services through the digital switch or multiplexer to the interactive cable
30 gateway and data channel gateways in the distribution hubs.

Digital switch or multiplexer 17 connects servers 15 and 16 to addressable controller 14, interactive cable gateway 18, and data channel gateways

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Analog satellite receivers 12 typically receive the satellite transmissions from the analog service providers in a modulated and scrambled NTSC format. Integrated Receiver Decoders 13 demodulate and

5 descramble the satellite signals into NTSC signals, and then analog scrambling and modulation circuitry scrambles using the cable system's scrambling method, if desired, and modulates the NTSC signals onto an analog 6 MHz FDM channel. The FDM modulation

10 frequencies and scrambling techniques used for the NTSC signals are preferably selected to maintain downward compatibility with analog set-top terminals which may be deployed at the time of implementation of the present invention. The demodulation, descrambling,

15 scrambling, and modulation functions performed by Integrated Receiver Decoders 13 and analog scrambling and modulation circuitry 20 could alternatively be performed by other dedicated devices such as satellite receivers, satellite decoders, NTSC scramblers, and

20 NTSC modulators, for example.

Digital services are received from satellite transmissions by digital satellite receivers 10. The signals received by digital satellite receivers 10 typically arrive in Quadrature Phase Shift Key (QPSK)

25 modulated, encrypted MPEG-2 transport stream format. Once the satellite transmissions have been received by the digital satellite receivers, Broadcast Cable Gateway (BCG) 11 converts the transmissions signals for transmission over the cable system's communication

30 network under the control of addressable controller 14. Broadcast Cable Gateway 11 demodulates, applies Forward Error Correction (FEC), if desired, and decrypts the satellite transmission to recover an MPEG-2 transport stream. The MPEG-2 transport stream may then be

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Each fiber transport 3 connects headend 2 to at least one distribution hub 4. Typically fiber transport 3 is physically configured as a ring of a bundle of fiber optic cables. In this configuration, 5 six cables in the bundle of each fiber transport 3 are usually dedicated to each hub 4 on the ring and each hub 4 is typically within twenty miles of the headend 2. By using selected fiber optic cables within the fiber transport's bundle, the distribution hubs may be 10 connected to the cable headend in a logical "ring," wherein each hub is connected to the headend through adjacent hubs, in a logical "star," wherein each hub is connected directly to the headend, or in any other logical configuration. In cases in which a 15 distribution hub 4 is more than a limiting distance (e.g., 20 or 60 miles) from headend 2, an intermediate distribution hub 4 may need to be used to repeat the signals in fiber transport 3. An advantage of configuring fiber transport 3 as a ring is that no 20 distribution hub 4 becomes cut off from headend 2 by a single break in fiber transport 3.

Hybrid Fiber Coax Plants 5 connect distribution hubs 4 to set-top terminals 6. In the preferred embodiment, hybrid fiber coax plants 5 25 comprise a plurality of fiber optic cables 25, a plurality of nodes 26, and a plurality of coaxial cables 27. A plurality of Radio Frequency (RF) amplifiers (not shown) may also be required in intermittent spacing throughout coaxial cables 27 to 30 compensate for losses which occur when the coaxial cable is split to connect each set top terminal. Nodes 26 are used to convert the optical signals in fiber optic cables 25 generated by the distribution hub 4 into electrical signals for transmission on coaxial

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19 in distribution hubs 4. Because the programs and services provided by application servers 15 typically do not require high bandwidth, these servers may be connected to digital switch or multiplexer 17 directly (as shown) or via intermediate networks. Media servers 16, however, do require a great deal of bandwidth, and accordingly should be connected to digital switch or multiplexer 17 or interactive cable gateway 18 directly until intermediate networks with sufficient bandwidth become available. Furthermore, to achieve their high bandwidth requirement, media servers 16 should incorporate storage devices utilizing interfaces achieving at least the speeds of SCSI Fast and SCSI Wide interfaces, with devices achieving the speeds of Ultra SCSI and Fiber Channel interfaces being preferred.

Interactive Cable Gateway (ICG) 18 processes the servers' signals so that they may be transmitted over the cable system's communication network. Signals received at ICG 18, either through digital switch or multiplexer 17 or from servers 15 or 16 directly, are encrypted, if desired, subjected to Forward Error Correction (FEC), if desired, and modulated onto a 6 MHz FAT channel using 64 or 256 Quadrature Amplitude Modulation (QAM).

The analog channels, forward application transport channels, forward data channels, and reverse data channels are transmitted between the cable headend and the set-top terminals over the cable systems' communication network. As shown in FIG. 2, this network comprises at least one fiber transport 3, at least one distribution hub 4, and at least one hybrid fiber coax plant 5.

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an IR transmitter 56, an accessories bus interface 57, and a 10-base-T interface 58.

Controlling the operation of set-top terminal 6 is Central Processing Unit 30. Preferably CPU 30 is a processor that can support 32 bit arithmetic and logical operations, that can operate at speeds of at least 25 MIPS, and that supports a system of dynamically prioritizable hardware and software interrupts. An example of a suitable processor for CPU 30 is the SUN Micro-Systems micro-SPARC core. CPU 30 operates by executing instructions stored in memory 32 under the control of an operating system such as the PowerTV Operating System by PowerTV, Inc. of Cupertino, California. CPU 30 accesses memory 32 through Memory Management Unit 31. MMU 31 provides memory protection for application processes and the kernel, and provides a flat address space for user processes.

Memory 32 comprises Non-Volatile Random Access Memory (NVRAM), Dynamic Random Access Memory (DRAM), Flash Read Only Memory (ROM), and Read Only Memory (ROM). NVRAM is used primarily for the storage of user settings and set-top terminal configuration settings such as parental control codes, favorite channel line ups, set-top terminal setups, channel maps, authorization tables, and Forward Data Channel address assignments, for example. At least 2 kbytes of NVRAM should be provided in memory 32. Dynamic RAM is used for most application and operating system storage requirements such as the stack, heap, graphics, Interactive Program Guide data, channel map, VCR codes, marketing data, and usage data, and functions such as MPEG-2 video decompression, AC-3 audio decoding, and video manipulation, for example. At least 3 Mbytes of Dynamic RAM should be provided in memory 32. Flash ROM

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cables 27 to set-top terminals 6. Return signals from set-top terminals 6 on coaxial cables 27 are converted to optical signals by nodes 26 for transmission in fiber optic cable 27 to distribution hubs 4.

5 As shown in FIG. 1, each distribution hub 4 comprises a plurality of data channel gateways 19 which support the Forward and Reverse Data Channels between headend 2 and set-top terminals 6. In the preferred embodiment of the present invention, the signals in the
10 Forward and Reverse Data Channels between headend 2 and data channel gateways 19 are Internet Protocol datagrams. Between data channel gateways 19 and set-top terminals 6, these Internet Protocol datagrams may be encrypted or decrypted, if desired, and QPSK
15 modulated or demodulated. Accordingly, data channel gateways 19 may include routing, encryption, decryption, QPSK modulation, and QPSK demodulation functions.

Referring to FIG. 3, one embodiment of a
20 set-top terminal 6 of the present invention is illustrated. As shown, a set-top terminal 6 comprises a Central Processing Unit (CPU) 30, a Memory Management Unit (MMU) 31, memory 32 comprising NVRAM, DRAM, Flash Read Only Memory (ROM), and ROM, an MPEG-2
25 decompression unit 33, an A/D converter 34, an IP router 35, a security unit 36, a QAM 64/256 demodulator 37, an NTSC decoder 38, a QPSK demodulate unit 39, a QPSK modulate unit 40, an in-band tuner 41, an out-of-band tuner 42, an out-of-band transmitter 43, an NTSC
30 encoder 44, an RF modulator 61, an RF output 45, an S-Video output 47, a baseband video output 48, a graphics subsystem 46, an audio subsystem 49, an AC-3 audio output 50, a baseband audio output 51, an I/O subsystem 52, a keypad 53, an LED display 54, an IR receiver 55,

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datagrams on the Forward Data Channel include Interactive Program Guide data messages as well as other data and control messages. The messages received by out-of-band tuner 42 are QPSK demodulated by QPSK demodulator 39 to reveal the IP datagrams. The analog NTSC baseband signals, the digital MPEG-2 payloads, and the digital IP datagrams are descrambled (if necessary), decrypted (if necessary), and screened by security unit 36. Additionally, security unit 36 provides encryption, key management, authentication, and secure transaction functions, and prevents downloading of viruses by authenticating trusted sources, vandalism of software, theft of services, falsified orders by using electronic signatures, tampering with the set-top terminal, and direct cloning or remanufacturing of the set-top terminal.

After descrambling, decryption, and screening by security unit 36, the baseband signals, MPEG-2 payloads, and IP datagrams are passed on to the Analog-to-Digital converter 34, MPEG-2 decompress unit 33, and IP router 35. As their names imply, Analog-to-Digital converter 34 converts the NTSC baseband signals to digital signals; MPEG-2 decompress unit 33 decompresses the MPEG-2 payloads; and IP router 35 routes the IP datagrams toward their ultimate destination.

Outgoing IP datagram messages are also processed by IP router 35. After routing the outgoing IP datagrams, security unit 36 screens and encrypts the IP datagrams (if necessary). The IP datagrams are then QPSK modulated by QPSK modulator 40 and transmitted to Hybrid Fiber Coax Plant 5 by out-of-band transmitter 43.

The video and audio outputs of set-top terminal 6 are generated by graphics subsystem 46,

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is used primarily for the storage of resident application software, as well as patches to the operating system and application software which are downloaded to the set-top terminal from the headend after the set-top terminal has been deployed in the subscriber's home. At least 1 Mbyte of Flash ROM should be provided in memory 32. ROM is used primarily for the storage of the operating system. At least 1 Mbyte of Read Only Memory should be provided in memory 32. Although specific uses of the NVRAM, DRAM, Flash ROM, and ROM are illustrated herein, these memory elements could be used for uses not listed and uses listed as corresponding to other elements without departing from the spirit and scope of the present invention.

Frequency Division Multiplexed (FDM) signals from headend 2 are initially received from Hybrid Fiber Coax Plant 5. In-band tuner 41 receives programs and services transmitted to the set-top terminal on analog channels and Forward Application Transport channels. These programs and services include analog programs and services from analog satellite broadcasts, digital programs and services from digital satellite broadcasts, some digital programs and services from application servers, and digital programs and services from media servers. NTSC decoder 38 receives the analog programs and services from in-band tuner 41 and produces NTSC baseband signals. QAM 64/256 demodulator 37 receives the digital programs and services from in-band tuner 41 and demodulates the signal into MPEG-2 payloads. Out-of-band tuner 42 receives only incoming IP datagram messages from headend 2 on the Forward Data Channel. Messages which are transmitted from the headend to the set-top terminals in Internet Protocol

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FIGS. 4 through 35 illustrate the operation of preferred embodiments of the application software of set-top terminal 6 of the present invention. Referring to FIG. 4, the operation of the channel selection function of one embodiment of the present invention is shown. From a first channel display 100, the channel selection function changes channels in response to the depression of a channel up/down key 102 on set-top terminal 6 or its remote control 59. Such a depression causes a second channel display 106 to be displayed. In the preferred embodiment of the channel selection function, a program information banner 114 is displayed indicating the current channel's channel number 116, the current channel's call sign 118, current time 120, the current program's name 123, running time 125, and elapsed time 127. Banner 114 may also include information regarding the program following the program currently being transmitted. Banner 114 is preferably displayed for a fixed period of time (e.g. 2 seconds) or until an information key 104 is depressed on set-top terminal 6 or its remote control 59. Pressing channel up/down key 102 again causes set-top terminal 6 to select the next channel in order. For example, as shown, pressing the up side of channel up/down key 102 causes the display to switch from channel 4 (KNBC) to channel 5 (HBO). Similarly to the initial display of second display 106, the initial display of a third channel display 108 may include a program information banner 122.

Additionally, in the preferred embodiments of the present invention, from a first channel display 100, pressing information key 104 causes a program information banner 124 to be displayed on first channel display 100. Similarly to program information banners

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audio subsystem 49, NTSC encoder 44, and RF modulator 61. Graphic subsystem 46 produces graphic images and scales MPEG-2 and NTSC video. NTSC encoder 44 generates S-Video output 47 and baseband video output 48 from digitized MPEG-2 and NTSC video. Audio subsystem 49 produces the audio outputs for set-top terminal 6 including AC-3 audio output 50 and baseband audio output 51. RF modulator 61 generates NTSC RF output 45 necessary to drive a television without S-Video or baseband inputs from signals received from NTSC encoder 44 and audio subsystem 49.

I/O subsystem 52 controls the input and output controls and the 10-base-T computer interface for set-top terminal 6. As illustrated in FIG. 3, I/O subsystem 52 receives inputs from keypad 53, I/R receiver 55, accessories bus 57, and 10-base-T interface 58. I/O subsystem 52 also produces outputs to LED display 54, I/R transmitter 56, accessories bus 57, and 10-base-T interface 58. Keypad 53 enables the user to control set-top terminal 6 without requiring the use of a remote control 59. LED display 54 provides a numeric display for channel or time indication, and a plurality of single LEDs to indicate statuses such as power on, message waiting, set-top output disabled, etc. I/R receiver 54 is used to receive and digitize input from remote control 59. I/R transmitter 56 is used to control a VCR 60 or send updates to remote control 59. Accessories bus 57 is used to connect to external equipment such as keyboards, joysticks, mouses, I/R transmitters, etc. 10-base-T interface can be used to connect to Ethernet interfaces in equipment such as routers, personal computers, or home entertainment equipment.

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example, to enter the number "50" on a three-digit selection set-top terminal 6, the user could enter the numbers zero, then five, then zero, or simply enter a five followed by a zero. In the later case, set-top
5 terminal 6 would automatically add the leading zero to the channel number and select the new channel accordingly.

In the preferred embodiments, the channel selection function of the present invention utilizes a
10 series of channel look-up tables as shown in FIG. 5. In order to select a particular channel number, set-top terminal 6 identifies the service associated with that channel using these tables. This may be accomplished by identifying the channel number in a channel table
15 101. Using channel table 101, set-top terminal 6 can identify a specific service associated with the channel through a pointer pointing from channel table 101 to a service table 103. For example, channel 5 is associated with a video service, channel 7 is
20 associated with a split service, channel 12 is associated with a music service, channel 14 is associated with a NVD service, channel 15 is associated with a VOD service, and channel 8 is associated with no (or a null) service. Other service
25 types, such as a home shopping service, a still image library service, an online database service, a World Wide Web browsing service, an E-Mail service, etc., may also be available as indicated for channel 16.

From service table 103, terminal 6 can also
30 identify the source of a channel's service and descriptive information for a channel's service. The source of a service can be determined from a parameter field within the service table which contains information that is sent to the service when the

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120 and 122, program information banner 124 may display the current channel's channel number, the current channel's call sign, the current time, the current program name, the program's running time, and the program's elapsed time. Like banner 114, banner 124 may also include information regarding the program following the program currently being transmitted. Pressing information key 104 again with program information banner 124 displayed may cause a more detailed program information banner 126 to be displayed on first channel display 100. Unlike banners 114, 122, and 124, more detailed program information banner 126 preferably does not display the running time and elapsed time but rather displays a brief description of the program's contents. As shown, program information banner 126 may omit the current program's name, or, as in the preferred embodiments, may include the current program's name.

Alternatively to changing channels using channel up/down key 102 as illustrated in FIG. 4, channel selection may also be accomplished by entering the number of the channel desired on a numeric keypad. Such a keypad is preferably present on remote control 59 and may also be present on set-top terminal 6.

Channel selection using a numeric keypad is accomplished by entering the channel number on the numeric keypad one digit at a time from left to right, optionally preceded by zeros if the number of digits in the channel number is less than the number of digits required for the channel selection function. For example, in a set-top terminal with three-digit selection, a user would enter the channel number "125" by pressing the one (1) key, followed by the two (2) key, and followed by the five (5) key. As another

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respectively. Accordingly, selecting channel 6 will cause the set-top terminal to display source 8 during time period one and source 9 during time period two.

Similarly to video parameter table 105, music parameter table 109 is provided to perform an identical function to table 105 but identify sources of music rather than sources of video. NVOD parameter table 127 provides information for NVOD programs which includes the number of sources and indication of each of the sources for the programs. VOD parameter table 129 provides information to set-top terminal 6 which enables it to provide VOD services to the cable subscriber, and other parameter table 131 provides information specific to other sources of programs and services.

By assigning channel settings based upon entries in service table 103 rather than entries in channel table 101, the present invention can withstand changes in channel line-ups by the cable operator without invalidating any of the user's channel settings. For example, once a parent configures the channel settings for a service such as "MTV" so that the service is blocked, a subsequent change in the channel line-up by the cable service provider will not affect the service's blocked status. In other words, blocking a service on a channel 1 at a time 1 will still be effective to block that service if the channel becomes available on channel 2 at a time 2. Similarly, other channel settings, such as favorite and record, operate in the same way. To prevent channel settings from ever becoming invalid during the life-time of the set-top terminal, in a preferred embodiment of the present invention, services are never deleted from service table 103. As new services become available,

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service is activated which information is specific to the selected channel. The source of a channel's service is determined by referring to video parameter tables 105, split parameter tables 107, music parameter tables 109, NVOD parameter tables 127, VOD parameter tables 129, or other parameter tables 131 pointed to by the parameter reference 123 corresponding to the service in the service table 103 pointed to by the channel number in the channel table 101. For example, looking up channel 2 in table 101 identifies the channel as using service 1 in table 103, which is a video channel according to column 111 and comes from source 1 according to table 105 as indicated by column 123. Descriptive information, e.g., information that can be displayed to the user in the interactive program guide, program information banner, or browse banner which can be used to identify the channel, such as call sign, logo, etc., for a channel's service is determined by referring to column 125 in service table 103.

Split parameter tables 107 allow a channel to be associated with two or more services, each during different time periods, including services of different types if desired and accordingly different sources. For example, from channel table 101 the set-top terminal determines that channel 7 is associated with service 6. Looking to table 103, the set-top terminal determines that service 6 is a split service and that it should refer to split parameter table 107. By referring to table 107, the set-top terminal identifies that service 6 is associated with service 10 during time period one (time1) and service 11 during time period two (time2). The set-top terminal then refers to video parameter table 105 to determine that services 10 and 11 are associated with sources 8 and 9,

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executed whenever the user selects a channel corresponding to that service.

To simplify the way in which requests for a service are made by different applications within set-top terminal 6, a preferred embodiment of the present invention incorporates a Uniform Resource Locator (URL) scheme, similar to that used on the Internet, to uniformly identify services required. Under this approach, services are identified by a URL (e.g., format://physical/logical/identity) which incorporates information about the format, physical location, logical location, and identity, of the service required. For example, a service could be requested by the set-top terminal which resides on a server at the headend. The URL for this service would identify that the service is in the headend's format, is located on a particular server at the headend, is located in a particular directory on that server, and may be found under a particular file name in that directory. Alternatively, a service could be requested which is resident in the set-top terminal. In this case, the service's URL might identify the service as being in a code segment format, located in the set-top terminal, within a particular block of memory, and at a particular memory address.

FIG. 6 illustrates the "Browse" mode of the present invention. The browse mode is entered by pressing the up, down, left, or right arrow keys whenever a program information banner or more detailed program information banner is being displayed. For example, from a television display 110 incorporating either a program information banner 124 or a more detailed program information banner 126, pressing up or down arrow keys 128 causes a browse information banner

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reserved space or space which is dynamically allocated within service table 103 is assigned to the new service.

Because of the variety of services available to users of the present invention, service table 103 may indicate to set-top terminal 6 how to process a request by a user to select a given channel. This determination may be made by inspecting service type field 111 in service table 103. For example, from channel table 101 and service table 103, the set-top terminal can determine that channel 2 corresponds to a video channel. After making this determination, the set-top terminal may execute a program (or run a special routine within the running program that allows channel selection) which tunes to the frequency of the service's source by referring to video parameter table 105, descrambles the signal if necessary, and displays the channel's content. Other types of service may require more interaction by the set-top terminal. For example, a request to view a channel incorporating a World Wide Web browser might instruct the set-top terminal to execute a resident copy of a web browser, request login information by the user, and establish a browsing session with the headend. Alternatively, the set-top terminal might request that a copy of a Web browser be downloaded to the set-top terminal from the headend and then execute the program in response to this channel request by the user. In this way, the set-top terminal is not limited in the types of services that may become available to the user. New types of services may be added to the cable system's offerings by downloading a new service type module to the set-top terminal wherein the module will be

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previously displayed channel 3 since the up side of channel up/down key 102 was depressed), and a program information banner 133 to be displayed for the new channel as shown in channel display 106.

- 5 Alternatively, pressing select key 136 with browse information banner 132 displayed causes set-top terminal 6 to tune to and display browse channel 138 and briefly display a program information banner 140.

The browse information banner can also be
10 used to display information for programs on at times in the past or future. For example, as shown in FIG. 7, browse information banner 152 can be used to display information for a program airing in twenty minutes from the current time. This can be done, for example, as
15 follows. From a program information banner 124 displayed within a television display 110, the browse mode of set-top terminal 6 is entered by pressing up arrow key 128. With the browse mode entered, a browse information banner 148 displays information for a
20 browse channel (i.e., channel 4, KNBC) during a browse period which straddles the current time (i.e., 8:10 pm). By pressing right arrow key 128, the browse period changes to the period for the next program on the browse channel. Alternatively, the user could
25 press left arrow key 128 to change the browse period to the previous program on the browse channel. In a similar fashion, by repeatedly pressing up, down, left, and right arrow keys 128, the user can view information for programs on other channels and at different times.

- 30 As described in connection with FIG. 6, once the user has viewed browse information banner 152, more detailed information can be obtained or the user can exit the browse mode of set-top terminal 6. For example, by pressing the information key 104 with the

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132 to be displayed. Browse information banner 132 displays information for programs other than that currently being displayed on display 110. As shown, a program entitled "Comedy: D. Miller" is being displayed on display 110 (see program information banner 124). However, browse information banner 132 reflects information for a program entitled "CBS Sports." In this way the user can determine what other programs are available for viewing while still observing the currently selected program. By repeatedly pressing up or down arrow keys 128, information on other television programs on at the current time can also be displayed on browse information banner 132. Pressing information key 104 whenever a browse information banner 132 is displayed causes banner 132 to be replaced by a more detailed browse information banner 142 displaying a brief description of the browse program rather than the browse running time and elapsed time. As with the program information banner 126, browse information banner 142 may omit the browse program's name (as shown), or, as in the preferred embodiments, may include the browse program's name.

The browse mode of set-top terminal 6 can be exited by pressing channel up/down key 102, by pressing select key 136, by pressing information key 104 whenever more detailed browse information banner 142 is displayed, or by waiting a fixed period of time (e.g., 20 seconds) without pressing any remote control 59 or set-top terminal 6 keys. More particularly, pressing channel up/down key 102 with a browse information banner 132 displayed, causes the banner to be removed from the display, the channel tuner to select and display the next channel following the previously displayed channel (in this case channel 4 follows the

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incorporated into the previously viewed television display 186 while leaving the television audio unaffected. Within channel settings menu 190, settings may be provided which allow the user to add the current
5 channel (i.e., KCBS) to the favorite channel list (setting 200), block the current channel (setting 202), and recording the current channel (setting 204). To select any of settings 200, 202, or 204, the user highlights one of the settings by positioning the
10 setting within cursors 198 and 216 by pressing up or down arrow keys 128. In the preferred embodiments of the present invention, cursors 198 and 216 remain in a fixed vertical position within menu 190 as the user presses up and down arrow keys 128 and the list of
15 settings scrolls such that the settings list comprising settings 200, 202, and 204 moves in the opposite direction of the key pressed. That is, when the user presses up arrow key 128, the list moves down and the cursor remains fixed, thereby giving the net effect of
20 the cursor moving up within the list. Set-top terminal 6 indicates that the user may press up and down arrow keys 128 to highlight different settings using cursors 198 and 216 by providing up and down arrow indicators 194 and 196. With cursors 198 and 216 on the desired
25 setting, the user may then enable or disable the highlighted setting by pressing left and right arrow keys 128. Similarly to up and down arrow indicators 194 and 196, menu 190 provides left and right arrow indicators 206 and 208 to indicate that the user may
30 press left and right arrow keys 128 to enable or disable the highlighted setting. Setting indicators 210, 212, and 214 will shift position to beneath either the "YES" column 218 or "NO" column 220 to indicate to

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browse information banner 152 displayed, the user causes browse information banner 152 to be replaced by a more detailed browse information banner 154. Banner 154 may replace the program name, running time, and elapsed time of banner 152 with a brief description of the browse program's contents. Alternatively, the browse mode may be exited by pressing channel up/down key 102 to view a new channel display 158 or by not pressing any keys on remote control 59 or terminal 6 for a fixed period of time (e.g., 20 seconds).

Although the browse banner shown in FIGS. 6 and 7 is illustrated as being activated from the program information banner by pressing the up or down arrow keys, the browse banner may also be activated by pressing the left or right arrow keys from the program information banner.

FIG. 8 provides a more detailed illustration of the browse information banner of one embodiment of the present invention. As shown, browse information banner 160 may display the browse channel's channel number 160, call sign 162, logo 164, a favorite channel icon 166, a blocked channel icon 168, current time 170, the browse program's name 172, running time 174, elapsed time 176, and icons to indicate whether the browse program is closed-captioned 178, has a Second Audio Program 180, is in stereo 182, and is designated to be recorded 184.

As shown in FIG. 9, a channel settings menu 190 allows the user of set-top terminal 6 to change the favorite, blocked, and record status for each channel. The user enables channel settings menu 190 by pressing a settings key 188 on set-top terminal 6 or its remote control 59 from any television display 186. As illustrated, channel settings menu 190 may be

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contents of the setting by pressing right arrow key 128 (as is indicated by right arrow indicator 246) or select key 136 to move cursor 226 to right half 248 of general settings menu 224. In cases where a setting has not been previously set or the contents of the setting have been erased, an indication such as "(New . . .)" will be displayed in right half 248 of menu 224 to indicate to the user that the setting is empty. When the user has completed using general settings menu 224, the user may exit the menu by pressing settings key 188 to return to previous television display 250. Alternatively to exiting the general settings menu 224, the user may also select another general setting by returning to the left half of menu 224 by pressing left arrow key 128, as indicated by left arrow indicator 244.

FIGS. 11 through 15 give illustrations of the VCR timers, IPPV purchases, all timers, and favorite channel settings of the general settings menu. Referring to FIG. 11, one embodiment of the VCR timers setting is shown. Selecting the VCR timers setting by pressing right arrow key 128 or select key 136 with VCR timers setting 256 highlighted in general settings menu 254 causes cursor 255 to be removed from the display and a new cursor 257 to be displayed in the left-most column of right half 248 of the general settings menu as shown in menu 258. In cases in which the VCR timers setting is selected when no contents for the setting exist, set-top terminal 6 will determine default contents for the setting. The contents may be either the current program being viewed prior to entering the general settings menu, or may be the next program to be aired if within a fixed period of time (e.g., 10 minutes) of the start time of the next program.

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the user whether each of the functions is enabled or disabled, respectively.

A general settings menu 224, as shown in FIG. 10, is also provided in a preferred embodiment of the present invention to enable the user to make further settings adjustments to set-top terminal 6. The user enters general settings menu 224 by pressing settings key 188 from channel setting menu 222. As with the channel settings menu 222, general settings menu 224 may be incorporated into the previously displayed television display 250 without affecting the television audio. Within general settings menu 224, the user may control settings such as blocked channels 228, favorite channels 230, VCR timers 232, IPPV purchases 234, sleep timers 236, and wake timers 238. Other settings available in general settings menu 224, but not illustrated, include reminder timers, view all timers, block times, setup blocking PIN, setup purchase PIN, set power-on channel, enable Second Audio Program (SAP), set audio output level, set AC outlet function, set VCR type, set clock options, control VCR on/off, and enable watch and record, for example. Similarly to channel settings menu 190 (FIG. 9), the user selects the desired setting by positioning the desired setting 228, 230, 232, 234, 236, or 238 within a cursor 226 using up and down arrow keys 128, as is indicated by up and down arrow indicators 240 and 242. As with channel settings menu 190, in the preferred embodiments of the present invention, cursor 226 remains in fixed vertical position within general settings menu 224 and the list of settings scrolling in a direction opposite to the direction of the up and down arrow keys depressed.

Once the desired setting has been highlighted by cursor 226, the user may then view or modify

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after modifying a timer setting's contents from within general settings menu 268, set-top terminal 6 checks to verify that there are no conflicts created by the modified setting. Conflicts can arise, for example, when there are overlapping timers, unusual settings (such as VCR record timers which exceed typical tape length), record timers for unpurchased Impulse Pay-Per-View (IPPV) events, attempts to set up more than a limiting number of VCR timers (e.g., eight), and attempts to purchase more than a limiting number of IPPV events (e.g., eight). For example, upon pressing select key 136 from general settings menu 268 when attempting to record an IPPV event, set-top terminal 6 will display an interactive warning window 270 alerting the user that the IPPV event sought to be recorded has not been purchased. Interactive warning window 270 then allows the user to press "B" or "C" application definable keys 252 in order to either buy the IPPV event or cancel the warning. Pressing select key 136 from general settings menu 268 for non-IPPV events causes another interactive warning window 272 to be displayed when there are conflicting timers. For example, interactive warning window 272 would be displayed when there is an attempt to record two different programs at overlapping times. As illustrated, the user has the choice of selecting one of "A," "B," and "C" application definable keys 252 in response to this warning in the preferred embodiment. Pressing "A" key 252 causes set-top terminal 6 to keep both settings and apply logic to resolve the conflict as shown in menu 274 ("VCR Timer 1" referring to the first setting and "VCR Timer 2" referring to the second). This could be accomplished, for example, in cases where two recording timers partially overlap by

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Pressing either up or down arrow keys 128 causes each parameter to cycle to the next higher or lower value for that parameter. As shown in menu 260, pressing up arrow key 128 causes the date to change from "Mo 23" to

5 "Tu 24." Pressing right arrow key 128 or select key 136 causes cursor 257 to be removed from the display and a new cursor (e.g., cursor 259) to be displayed in the next, rightward, parameter as shown in menu 262. Alternatively, pressing left arrow key 128 causes

10 cursor 257 to be removed from the display and a new cursor to be displayed in the previous parameter. By using arrow keys 128 in this fashion, the user is able to select the date, channel, start time, and stop time for the VCR timers setting.

15 Once the user has completed modifying the contents of the VCR Timers setting, the user may accept or cancel the modifications as indicated by "A" and "C" indicators 261 and 263. In order to accept the modified setting, the user presses the "A" application

20 definable key 252. If the user accepts the settings, a cursor will be displayed in list of settings 249 and the modified setting will be displayed as shown in menu 264. In order to cancel the modified setting, the user presses "C" application definable key 252.

25 Alternatively, if left arrow key 128 is pressed when a cursor is displayed in the left-most column in right half 248 of the general settings menu (as shown in menu 258), any changes to the setting will be canceled. Once canceled, a cursor will be displayed in the list

30 of settings 249 and the prior contents of the setting will be displayed.

FIG. 12 illustrates the conflict checking feature of the present invention. Upon pressing select key 136, settings key 188, or channel up/down key 102

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290 by pressing stop key 282 with a particular purchase highlighted. For example, with "9/18 The Fugitive" highlighted in menu 292, pressing stop key 282 causes "9/18 The Fugitive" to be removed from the subsequent
5 list 296 in the subsequent menu 294. As with highlighting different settings 249 in the general settings menu, the IPPV purchases are highlighted by positioning the IPPV purchase within cursor 255 using up and down arrow keys 128. Like the cursor in the
10 general settings menu, cursor 255 is preferably fixed in vertical position.

When done reviewing list 290 of past and pending IPPV purchases, the user may press the "A" application definable key 252 to exit. In response,
15 the present invention removes the list from right side 248 of the general settings menu, replaces the list with an updated summary indicator 300, and highlights IPPV Purchases setting 286. In an alternate embodiment of the present invention (not shown) the user may also
20 press "C" application definable key 252 to cancel any IPPV cancellations which were made by highlighting a pending IPPV event and pressing stop key 282.

FIG. 14 illustrates an illustrative embodiment of the all timers setting of the general
25 settings menu. As shown, selecting all timers setting 323 within general settings menu 322 causes a list 325 of type 324, day 326, date 330, time 332, channel number 334, and channel call sign 336 for each active timer in set-top terminal 6 to be displayed. As with
30 IPPV purchases (see the description accompanying FIG. 13), pressing stop key 282 with any timer highlighted causes that timer to be canceled and accordingly removed from all timers list 325. As indicated by up and down arrow indicators 327 and 329, up and down

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recording up until the start time of the second program and dropping the end of the first program. Pressing "B" key 252 in response to interactive warning window 272 causes the conflict to be resolved by the new
5 setting overwriting the old setting as shown in menu 276. Pressing "C" key 252 in response to interactive warning window 272 causes the old setting to be retained in general settings menu 278 and cursor 226 to remain displayed on right side 248 of the general
10 settings menu to indicate to the user that the most recent setting has not been accepted.

When the user exits general settings menu 268 by pressing settings key 188 or channel up/down key 102 while leaving behind a conflicting setting, a non-
15 interactive warning window 280 is displayed for a brief period of time (e.g., five seconds) to inform the user of the conflict. In order to resolve the conflict, the user must press settings key 188 to reenter the general settings menu. Upon reentering the general settings
20 menu, the user will be prompted with interactive warning window 272 so that the conflict can be resolved using the procedure previously described.

FIG. 13 illustrates the Impulse Pay-Per-View (IPPV) purchases setting of the general settings menu.
25 As shown in general settings menu 284, whenever IPPV Purchases setting 286 is highlighted, a summary indicator 288 is displayed in right half 248 of the general settings menu. Indicator 288 indicates the number of past and pending IPPV purchases. Pressing
30 right arrow key 128 or select key 136 causes summary indicator 288 to be replaced by a list 290 of past and pending purchases as shown in general settings menu 292. In the preferred embodiments of the present invention, a pending purchase can be removed from list

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the cursor's stationary position. Thus, the stationary cursor reacts in the same manner (to highlight the underlying cell) irrespective of the direction of movement of the underlying program grid 366.

5 As shown in FIG. 16, in a preferred embodiment of the present invention, channel list 350 rolls over when either the beginning or end of the list is reached. For example, as the user scrolls list 350 upward, thereby giving the appearance of the channel
10 shadow moving downward with respect to the list, the user will eventually reach the end of the list of available channels. Rather than simply preventing the user from scrolling list 350 any further when at the end of the list, set-top terminal 6 displays the
15 beginning of the list following the end of the list and allows the channel shadow to move to the top of the list. In this way, channel list 350 appears to be a circular list of channel numbers. Similarly, when the user scrolls list 350 downward, thereby giving the
20 appearance of the channel shadow moving upward with respect to the list, the bottom of list 350 will appear as the user scrolls past the beginning of list 350. This feature of list 350 may also be applied to other lists within the present invention, including lists of
25 settings, IPG guide data (in grid format), etc. Alternatively, the present invention may incorporate lists in which the lists do not roll over. In this situation, the user would not be able to continue scrolling the channel list in the same direction once
30 the top or bottom of the channel list has been reached.

As described in connection with FIG. 5, the present invention makes special provisions for channels which are split in time between two or more sources. As shown in FIG. 17, channel "147" within interactive

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"4:00 pm" in date and time bar 348 are shadowed by channel shadow 392 and time shadow 393, respectively, to indicate that "CBS Sports..." is on channel "KCBS 2" at "4:00 pm."

5 In the preferred embodiment of the present invention, cursor 394 does not move within grid 366 of the interactive program guide. Program cells 396 of grid 366, call signs 388 and channel numbers 390 of channel list 350, and times 386 of date and time bar
10 348 scroll instead. For example, as the user presses up and down keys 128, call signs 388 and channel numbers 390 in channel list 350 and program cells 396 in grid 366 scroll down and up, respectively. As the user presses left and right arrow keys 128, times 386
15 in date and time bar 348 and program cells 396 in grid 366 scroll right and left, respectively. In the vertical directions, call signs 388, channel numbers 390, and cells 396 scroll one row for each depression of up or down arrow key 128. In the horizontal
20 direction, times 386 and cells 396 scroll by one increment in the times of date and time bar 348 (e.g., one half hour as illustrated) for each depression of the left or right arrow key 128. Alternatively, in the horizontal direction, times 386 and cells 396 could
25 scroll to the next program cell 396 immediately following the currently highlighted program cell 396 when the user presses right arrow key 128, and scroll to the previous program cell 396 immediately preceding the currently highlighted program cell 396 when the
30 user presses left arrow key 128. After the cells have scrolled up or down, or left or right, the stationary cursor 394 expands or contracts to highlight (preferably entirely) the leftmost program cell, and only the leftmost program cell, that has moved under

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scroll in time, causing the cursor to highlight either the contents of an earlier or later cell under the action of left and right arrow keys 128, respectively. Similarly, pressing either up or down arrow keys 128

5 causes the cell contents to scroll vertically either down (with the contents of cell 407 moving to the position of cell 406) or up (with the contents of cell 409 moving to the position of cell 406), respectively, as shown in IPG 408. As the cell contents of grid 366

10 scroll up and down, the contents of channel list 350 also simultaneously scroll in the same direction.

After scrolling the contents of grid 366 to highlight a program other than the one currently being watched, pressing select key 136 causes the interactive

15 program guide to be removed from the display and the channel selection function to select the new program as illustrated by display 410. As shown, a program information banner 412 may be incorporated into display 410 for a fixed period of time (e.g., two seconds) to

20 indicate to the user that the selected program is being displayed. In cases where the user does not wish to switch to a new program, pressing guide key 398 with the interactive program guide displayed causes the display to revert back to original television display

25 396.

FIG. 19 illustrates switching between different modes of the interactive program guide. From a time mode display 414 of the guide, pressing "B" application definable key 252 causes a theme mode

30 display 416 of the guide to be presented. As illustrated, the theme mode is indicated by region 341 being highlighted. Pressing "C" application definable key 252 from time mode display 414 causes title mode display 418 of the guide to be displayed. Similarly to

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program guide display 361 is split between "BRAV" 363 and "LIFE" 365. As illustrated, channel "147" switches from "BRAV" to "LIFE" at 5:00 pm. Similarly, other splitting arrangements could be configured. For example, channel "147" (or any other channel number for that matter) could be used for three different sources daily such as "BRAV" from 12:00 am to 7:59 am, "LIFE" from 8:00 am to 3:59 pm, and "QVC" from 4:00 pm to 11:59 pm. In such an arrangement, channel 147 could be presented in program grid 366 in at least two manners. First, each of the sources, "LIFE," "BRAV," and "QVC," could be assigned a row in grid 366 at all times during the day regardless of whether the source is "ON AIR" during the time window displayed in the guide. Second, only those sources that are at least partially "ON AIR" during the time window displayed in the guide would be allocated a line in grid 366. In this second approach, for example, displaying programs with times ranging from 3:00 pm to 4:30 pm would show a split at 4:00 pm with only two lines of the program guide allocated to channel 147.

FIG. 18 further illustrates the navigation features of the interactive program guide of the preferred embodiments of the present invention. Referring to FIG. 18, from any television display 396, pressing guide key 398, causes set-top terminal 6 to enter the time mode of interactive program guide 400. As shown, pressing right arrow key 128 causes the contents of cell 404 to scroll to cell 406 as illustrated in IPG 402. Similarly, the contents of all other cells scroll from their current position to the cell immediately to their left. Likewise, pressing left arrow key 128 causes the contents of the cells to scroll to the right. In this way, the cell contents

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the user enters theme mode display 420 may correspond to the program being viewed in program viewing window 340 or, alternatively, a program highlighted in a prior mode display of the interactive program guide. For
5 example, entering the interactive program guide while watching "CBS Sports Special" and then selecting the theme mode will cause the theme "Sports" to be highlighted with "CBS Sports Special" centered in program list 432 next to right arrow indicator 434.

10 Once the user has highlighted and selected a theme from theme list 424, set-top terminal 6 replaces theme list 424 with a selected theme indicator 436 as illustrated in FIG. 21. Up and down arrow indicators 437 and 439 are also provided to indicate that the user
15 may scroll through and highlight with cursor 440 a program within program list 432 by pressing up and down arrow keys 128. As with other lists in the present invention, cursor 440 is preferably stationary within the IPG display and list 432 scrolls to make the cursor
20 appear to move with respect to list 432.

 In some embodiments of the present invention, by scrolling through program list 432 the user can see not only those programs within the selected theme, but also programs in other themes. This is facilitated by
25 program list 432 comprising all programs for which data is available and by program list 432 being sorted primarily by program theme. In addition to being primarily sorted by theme, programs in program list 432 may also be secondarily sorted by time and title (as
30 shown) or by any other set (or one) of the program characteristics. When a user selects a particular theme, set-top terminal 6 displays that portion of program list 432 in which the programs of the selected theme are positioned. The user may then scroll through

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the theme mode, the title mode is indicated by region 343 being highlighted. From either the theme mode or title mode, pressing "A" application definable key 252 causes the display to switch to time mode display 414.

5 From the theme mode, pressing "C" application definable key 252 causes title mode display 418 to be displayed. From title mode display 418, pressing "B" application definable key 252 causes theme mode display 416 to be displayed. Accordingly, pressing "A" key 252 from any
10 IPG display causes time mode display 414 to be displayed, pressing "B" key 252 from any IPG display causes theme mode display 416 to be displayed, and pressing "C" key 252 from any IPG display causes title mode display 418 to be displayed.

15 The theme mode display of the interactive program guide is further illustrated in FIG. 20. As shown, date and time bar 348, channel list 350, and program grid 366 of the title mode display (FIG. 16) are replaced by a theme and programs bar 422, a theme
20 list 424, and a program list 432 in theme mode display 420. Similarly to channel listing 350, all available themes will not be displayed simultaneously when the length of themes listing 424 is greater than the available space in theme mode display 420. Up and down
25 arrow indicators 426 and 428 are provided, however, to indicate to the user that list 424 may be scrolled by pressing up or down arrow keys (not shown). Using up and down arrow keys, the user can scroll list 424 to highlight a desired theme with cursor 430. A right
30 arrow indicator 434 is also provided to indicate to the user that a highlighted theme must be selected by pressing right arrow key (not shown) or select key (not shown) in order to scroll through program list 432. As shown, the default theme and program highlighted when

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pressing the left arrow key (not shown) as indicated by left arrow indicator 438.

The title mode of the interactive program guide of the present invention is illustrated in FIG.

- 5 22. Like the theme mode, the title mode replaces the date and time bar 348, channel list 350, and program grid 366 of the time mode display (FIG. 16) with an alphabet and program bar 446, an alphabet list 448, and a program list 450 as shown in title mode display 444.
- 10 Alphabet list 448 displays the letters of the alphabet from A through Z and allows the user to highlight a desired letter using cursor 452. Similarly to the theme mode display, a default letter and program name are displayed upon entering the title mode display of
- 15 the interactive program guide. The default letter and program name selected may be based upon the program being displayed in program viewing window 340 or, alternatively, a program highlighted in a previous mode of the interactive program guide. For example, with
- 20 "CBS Sports Special" being displayed in program viewing window 340, the default letter and program are accordingly chosen as "C" and "CBS Sports Special," respectively.

- By using up and down arrow keys (not shown),
- 25 as indicated by up and down arrow key indicators 454 and 456, the user can highlight a desired letter with cursor 452 by scrolling alphabet list 448. As with other lists in the present invention, cursor 452 is preferably stationary within the IPG display and list
- 30 448 scrolls to make the cursor appear to move with respect to list 448. Once a desired letter has been highlighted, the user may select that letter and enter the program list 450 by pressing right arrow key (not

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not only that portion of the list containing the programs of the selected theme but also programs in other theme areas.

By highlighting a desired program in program list 432, information for that program may be displayed to the user. As shown in FIG. 21, information for the program highlighted in program list 432 is displayed in channel banner 344 and program summary 346. More particularly, channel banner 344 may indicate the channel number, call sign, and logo for the channel showing the highlighted program, and program summary 346 indicates the program title, running time, description, and characteristics for the highlighted program. As also shown, redundant information such as the date of the programs listed in program list 432 may be incorporated into theme and programs bar 422 when appropriate to save space in theme mode display 420. Stars 442 (or any other symbol) may be indicated for those programs in list 432 currently available for viewing. Likewise, other indicators could be displayed to indicate other program characteristics such as favorite channel, blocked channel, etc.

Once the user has completed viewing the program list 432, the user may select a program for viewing or alternatively return to the theme list to select another theme. The user may select a program for viewing by highlighting a program with cursor 440 and then pressing select key (not shown). Set-top terminal 6 will then switch to the corresponding channel when the program is a past or current program, or set a reminder timer when the program is on at some time in the future. Alternatively, the user may return to theme list 424 in order to select another theme by

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description, and characteristics for the highlighted program. As with the theme mode display, stars 468 may be displayed adjacent to some programs to indicate that those programs are currently available for viewing.

- 5 Similarly, other icons could be displayed to indicate other characteristics of the programs in program list 450 such as favorite channel, blocked channel, etc.

Once the user has completed viewing program list 450, the user may select another letter from
10 alphabet list 448 by pressing left arrow key (not shown) as indicated by left arrow indicator 468. Alternatively, pressing select key (not shown) when any program is highlighted by cursor 462 causes the program guide to switch to the corresponding channel when the
15 program is a past or current program, or set a reminder timer when the program is on at some time in the future.

FIG. 24 illustrates the One-Touch Recording (OTR) feature of the present invention. From an
20 interactive program guide display 470, pressing record key 472 with a program 474 highlighted causes a VCR timer to be set up for the highlighted program 474 and a to-be-recorded indicator 476 to appear in program summary 346, as illustrated in display 478. In order
25 to fine-tune the settings of the VCR timer set up by the OTR feature, the user may enter the general settings menu by pressing settings key 188. As shown in general settings menu 480, by highlighting and selecting VCR timers setting 482, the user can modify
30 the recording settings 484 for highlighted program 474.

As discussed in connection with the general settings menu (see FIG. 12), conflict detection and resolution is also incorporated into the OTR feature of the present invention. Conflict detection and

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shown) or select key (not shown), as indicated by the right arrow indicator 458.

As shown in FIG. 23, once the user has selected a letter from alphabet list 448 (FIG. 22), a selected letter indicator 460 replaces alphabet list 448 to indicate that a letter has been selected, and a cursor 462 appears in program list 450. This cursor is used to scroll through and highlight a program in program list 450. Up and down arrow indicators 464 and 466 are provided in display 444 to indicate to the user that program list 450 is scrolled by pressing up and down arrow keys 128. As with other lists in the present invention, cursor 462 is preferably stationary within the IPG display and list 450 scrolls to make the cursor appear to move with respect to list 450.

In some embodiments of the present invention, by scrolling through program list 450, the user can see not only those programs beginning with the letter selected from alphabet list 448, but also those programs beginning with other letters. This is facilitated by including in list 450 all programs for which data is available and sorting the list by program title. When displaying the list to a user after the user has selected a letter from list 448, set-top terminal 6 centers the displayed portion of list 450 on the portion of the list with program titles which begin with the selected letter.

Once a program has been highlighted using cursor 462, channel banner 344 and program summary 346 each display information for the highlighted program. More particularly, channel banner 344 indicates the channel number, call sign, and logo for the channel showing the highlighted program, and program summary 346 indicates the program title, running time,